A PRIMER OF HEALTH

THE NEW HEALTH SERIES
OF
SCHOOL PHYSIOLOGIES

STOWELL

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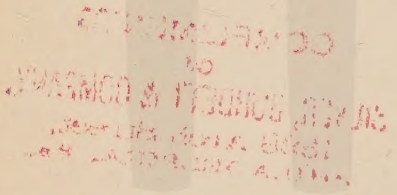

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A PRIMER OF HEALTH

PRACTICAL HYGIENE

FOR PUPILS IN

PRIMARY AND LOWER GRADES

BY

CHARLES H. STOWELL, M.D.

COMPLIMENTS
OF
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INDORSEMENT.

WE, the undersigned, have carefully read the first book of The New Health Series of Physiologies, "A Primer of Health" (revised edition), by Dr. C. H. Stowell, and are happy to note the full and adequate teaching which this book contains of the physiological reasons for obeying the laws of health, including those that relate to the nature and effects of alcoholic drinks and other narcotics upon the human system.

The truths taught are well told in language adapted to pupils of the fourth grammar grade, or to corresponding classes in ungraded schools, for which grade or classes we recommend this book.

MARY H. HUNT,

Life Director of National Educational Association; National Director of Bureau of Scientific Temperance Investigation; and World and National Superintendent of the Department of Scientific Temperance Instruction of the Woman's Christian Temperance Union.

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THE NEW HEALTH SERIES OF SCHOOL PHYSIOLOGIES

A PRIMER OF HEALTH
For Primary and Lower Grammar Grades.

A HEALTHY BODY
For Intermediate Grammar Grades.

THE ESSENTIALS OF HEALTH
For Higher Grades.

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PREFACE

This little book is intended for use in the early years of school life and has, therefore, been written in a style simple and easy enough to come within the comprehension of children in the primary grades. No school-child is too young to form right habits with regard to personal cleanliness, neatness in dress, and good manners, or to learn the simpler rules for the preservation of health—what foods are most wholesome, what clothing is most suitable, the necessity of pure air in schoolroom and sleeping-room, the value of proper exercise, and the dangers of over-exertion. It is the province of the teacher to see that the pupil is provided with the proper kind of desk and seat, but the child himself should be made to understand the difference between a right and a wrong position in sitting or standing, and the reasons why one will bring comfort and self-poise and the other discomfort and perhaps even deformity.

Even during play-hours due attention should be given to hygienic rules. When a child learns to control and govern himself unconsciously in his sports, to the good of both himself and his play-mates, it cannot but make for better discipline in schoolroom and home.

Aware of the great harm that may result from the use of alcoholic beverages or tobacco, the author has included in this volume such facts relating to the effects of these habits as are adapted to the comprehension of very young children. The plain truths of science on these points have been treated without bias or exaggeration, and the book meets the requirements on these subjects as prescribed in several states of the Union for the teaching of physiology and hygiene in the public schools.

The very cordial reception given to "A Primer of Health" has encouraged the author to present this revision, which contains all the distinctive features that contributed to the success of the first edition, treated in the light of still more recent scientific investigation. To the teachers of our country the author submits this volume, believing that the simple truths taught herein cannot fail, if properly applied, to help our boys and girls to develop physically, and at the same time mentally, into stronger and better men and women.

LOWELL, MASS., *April, 1906.*

CONTENTS

CHAPTER		PAGE
I.	Why we Eat	1
II.	Foods we Should Eat	6
III.	How we Digest our Food	13
IV.	More about Digestion	21
V.	Eating and Drinking	25
VI.	The Blood	28
VII.	The Heart and the Blood Vessels	31
VIII.	Care of the Heart	38
IX.	Breathing	42
X.	Breathing and Health	47
XI.	Alcohol	53
XII.	Alcoholic Liquors	60
XIII.	The Effects of Alcohol	65
XIV.	Tobacco	69
XV.	Reasons why Boys should not Smoke	73
XVI.	The Muscles	76
XVII.	Exercise	81
XVIII.	The Clothing	86

CHAPTER PAGE

XIX. The Skin 91

XX. The Bones 97

XXI. The Skeleton and the Joints 100

XXII. The Care of the Bones 108

XXIII. The Brain, Spinal Cord, and Nerves 113

XXIV. The Sense of Sight 120

XXV. Smell, Taste, Touch, and Hearing 124

INDEX 127

A PRIMER OF HEALTH

CHAPTER I

WHY WE EAT

The Growth of the Body.—You are much larger now than your baby brother or sister, yet you were once just as small. In a few years more you will be larger still, and after a while you will be "grown up." What is it that makes you grow so fast? Is it the air you breathe, or the water you drink? No, not entirely; you must have air and water, it is true, but you would not live long on them

alone. Let us think of the plants, to see if we can find out what it is that makes *them* grow, then, perhaps, you will more easily understand what makes *you* grow.

Can you tell why it is that in a few years a small young tree will grow large enough for you to climb? Would it grow if you should pull it up and place it on the floor in the house? If you should, its branches would never be strong enough to hold up a swing. Would the plants in the flower garden give you their beautiful flowers if you should pull them up by the roots? No, indeed; they would soon lose their leaves and blossoms if they were so badly treated.

We know that the trees and plants need something more than fresh air, water, and sunlight.

Food.—Notice how many roots the trees and plants have. The large roots, with their little branches, go down deep into the earth and take from it something necessary to the life of the leaves and flowers above the ground. What do the little roots find? Food. What

makes the trees and flowers grow? Food. What makes boys and girls grow to be strong men and women? Food.

Will it make any difference what kind of food we give to the plant? You say one person's plants always look fresh and thrifty, while his next-door neighbor never has any luck with flowers. But it is not "luck." One knows what kind of food to give his plants, while the other does not. He knows what soil is best for certain plants, as well as how much sunlight and water are needed. Will it make any difference to boys and girls what kind of food they have? We shall see farther on.

What a difference between the looks of the dark, damp soil and the beautiful violets! Yet in some way the roots of the violet take food from the earth and change it, so that the leaves are made to grow, and the flowers to bloom.

How is it with your own body and the food you eat? Do they look anything alike? Yet the food becomes changed, in some way, into all the different parts of the body.

We have seen that the body needs food in order to grow. It has also other uses for food. Just think a moment. A full-grown person may eat heartily three times each day and never grow any taller or any more fleshy. Why does he eat food if it does not make him grow?

Our Bodies Wear Out.—While you were waiting at the station, did you ever see an engine standing there, puffing, puffing? Notice how carefully the engineer oils the joints and polishes the brass trimmings. Sooner or later, though, this great machine will wear out. It began to wear the very first time it moved; and now, every little while, the engineer is obliged to take away some badly worn piece and put a new one in its place. The engine wears out, and has to be repaired.

It is so with our bodies; they are constantly wearing out. Every slight motion of the body causes a small amount of wear; while such active work as running and jumping causes the body to wear out much faster.

Food for Repair.—Some one asks, Why do we not waste all away if the body is constantly wearing out? Because the body is repaired. The food we eat is changed into the parts of the body that are wearing out. In answer to our question, Why do we eat? you are now ready to answer: Because the food keeps the body in repair, so that it will not waste away, and because it makes the bodies of young people grow.

The boys and girls for us are those who, as they grow larger and older in body, grow purer and truer in heart.

CHAPTER II

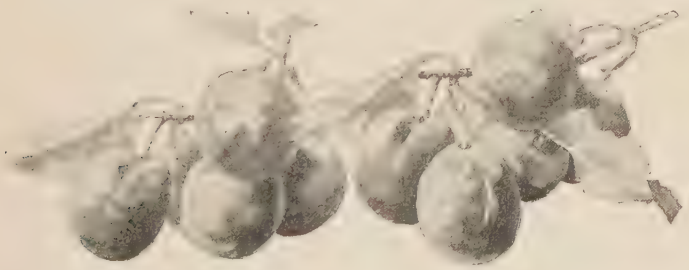
FOODS WE SHOULD EAT

The Best Foods.—Since food becomes changed into our own bodies, we should be very careful to eat only the best foods. Now the best foods are not always the most expensive; indeed, some of them are the cheapest.

What is one of the best foods? You all know the answer: milk. A better food cannot be imagined. Children live on it for years, and many grown people use it freely. It is a much better food for young people than meat; and it is a far better drink than tea or coffee. It is well for every boy and

girl to have a large glass of pure milk three times a day.

What other food do we usually eat three times a day? Bread and butter; it is a food nearly as valuable as milk. Eggs are perhaps the next best food, only they should not be cooked too hard. Beef is a good food; it



should be roasted or broiled and served rare. Mutton is also a good food; but veal and pork are not so good.

Fruit.—Some kind of fruit grows in nearly every part of the world. Birds feed it to their young and almost all animals except the flesh eaters like it. Boys and girls like fruit so well that they are apt to make themselves sick by eating too much of it, or eating it when it is not in proper condition. A certain

amount of ripe fruit is good for us, but we must be careful not to eat it when it is either unripe or over-ripe.

Do we Need Sweets? — There are some things of which you should eat sparingly. You may guess the names of some of them,— rich cakes and pies, rich puddings, hot bread, and pork.

Did you ever hear of a boy or girl who did not like candy? It really seems that the desire for sweet things is a natural one. For this reason a proper amount of sugar should be used in the food. Ripe apples, peaches, and oranges are sweet because they contain sugar. But if you do not have enough sugar in your food and in the fruit you eat, and you still desire something sweet, then ask mother for some home-made candy. You should remember, however, that if you eat too much sugar, you may disturb the stomach and take away the appetite for good food.

The Best Drink.—Is there anything that tastes better, when you are thirsty, than a glass of pure, cool water? Did you know that

a person will die sooner without water than he will without food? What should we do without water! How eagerly the horse and the dog drink it! Notice how the birds bathe

in it! Even the plants love it, for no matter how their leaves may droop in the hot sun, the evening dew or the brisk shower brings back to them all their freshness and beauty.

About three-fourths of the weight of the body is water; so that if you weigh eighty pounds, nearly sixty pounds of it is water.

Ice-Water.—We take a large amount of water in our food, but not enough to satisfy our thirst. We are obliged to take a great deal of water as drink. Yet we should never drink a large amount of ice-water with our meals. It is likely to chill the stomach and prevent it from doing its work properly. It is a dangerous practice to drink a glass of ice-cold water when the body is overheated. Cold water quenches thirst as well as ice-water, and there is less danger in its use.

But even cold water should be sipped slowly when the body is very warm.

Pure Drinking Water.—It is very important that the water we drink should contain no impurities. People are often made ill by drinking water into which foul matter has found its way. Wells should always be at a distance from cesspools or stables. Streams that supply towns with water should never receive any kind of drainage in any part of their course.

The Need of Salt.—Those of you who live in the country, or have been there on a visit,

have seen the cows and the sheep come hurrying to answer the farmer's call. They hope he may have some salt for them. Watch how eagerly they eat it! It must be that these

animals need salt, or they would not be so anxious for it. We, too, need salt with our food. We would soon tire of many articles of food if no salt were added to them.

The Bones Need Lime.—Feel the bones in your hand, especially at the joints and knuckles. Notice how much harder bone is

than the flesh around it. This is because bone is made largely of lime. When the body is growing, the bones must be fed with lime. Where can you get this lime? You do not add it to the food as salt is added, and yet you must have a great deal of it. This is the way it is obtained. The growing grass and the grain take lime from the soil. The cows eat the grass and change some of it into milk, and when you drink the milk you get the lime. We obtain the lime from the grains by grinding the wheat into flour and making the flour into bread.

When there is not enough lime in the body the bones are soft and easily bent. The teeth also are soft and decay very easily. Therefore, when the body is young and growing rapidly, it should be supplied with plenty of lime. We have now given you another reason why bread and milk are so useful for young people.

CHAPTER III

HOW WE DIGEST OUR FOOD

Choosing Meat.—Let us sit down together for a good dinner. What meat will you take? We have beef and mutton. Or you may have eggs if you prefer. We have no pork, because, if used at all, it should be used only by those who work hard and are very strong and hearty. You may have the beef or mutton either broiled, boiled, or

roasted. We do not fry them, because frying makes them hard and greasy.

Vegetables.—What vegetables will you have? There is a long list from which we

RAISING VEGETABLES IN A VACATION SCHOOL GARDEN

might choose, but we will be satisfied to give you some potatoes, thoroughly cooked; tomatoes, raw or cooked; and some rice that has been cooked until it is soft.

Hot Bread.—Would you like some hot bread? We cannot give it to you at our

table, because, when fresh and hot, it often causes trouble with the stomach. But you may have cold bread and fresh butter. It is a valuable food, and you will find that it tastes good.

Spices.—Just a little salt, did you say? Yes, a trifle,—enough to give a good flavor to the food. Not any pepper, or at least you must be satisfied with very, very little. Too many spices, like pepper, cloves and cinnamon, are not good for the stomach.

What to Drink.—Now, what will you have to quench your thirst? Hot tea or coffee? Iced tea or cold lemonade? No, indeed, none of these; for very hot and very cold drinks, especially at meal-time, are injurious. Then, too, neither tea nor coffee is good for the growing body. So we will offer you a glass of cold water and another glass of milk; or if you prefer, you may take a second glass of milk in place of the meat.

For Dessert.—Are you already anxious for your dessert? We have a delicious boiled custard to offer you today. Some days we have light puddings, but we do not believe much in rich pastries.

We will now close our dinner with a little fruit and a few nuts. Acid fruits are better eaten at the end of a meal, as they make the digestion of starchy foods more difficult if taken at the beginning. Sweet grapes, berries, or melons may be eaten before breakfast if we like them and if we find that they agree with us.

Other Foods.—There are other good articles of food, such as oysters, chicken, turkey, celery, and cooked fruits. But pork, sausage, salt meats, lobsters, cucumbers, and pickles we would rather not pass to you.

The Beginning of Digestion.—We have now been some time at the table, for we eat slowly and talk cheerfully while we eat. Unpleasant topics should never be brought up at the table, for when the mind is disturbed digestion does not go on well.

Let us now see what has taken place while we were eating. As soon as we place some solid food in the mouth and begin to chew, what happens? There comes into the mouth a juice which moistens and mixes with the food so that it can be swallowed easily. This juice is called the saliva.

Chewing the Food.—Why did you chew the solid food? Why not swallow it in large pieces instead of crushing and grinding it with the teeth? Because the solid food must be in small pieces when it reaches the stomach, or there is danger that the stomach will not do its work well. One of the most common causes of stomach trouble is that the food is not chewed so fine as it should be.

Our Tools for Chewing.—Can you tell how many teeth there are in the first set? Just

ten in each jaw. But at five or six years of age these begin to loosen; they either fall out, or are pulled, and the second set appears. When we have all the teeth of the second set, there are sixteen in each jaw. Some of the teeth, the front ones, are sharp for cutting,

Fig. 1. Teeth from the second or permanent set. 1, a front tooth; 2, an eye-tooth; 3, back teeth from the lower jaw, 4, back teeth from the upper jaw.

while the back teeth are for grinding and crushing.

Care of the Teeth.—Did you ever have a tooth pulled, or suffer from the toothache? Not very pleasant, was it? We should try to keep our second teeth all our lives. A few simple rules may aid us in doing this:—

1. Do not crack nuts between the teeth, or bite other things that are very hard.

2. Do not pick them with any hard substance, like a pin.

3. Clean them with a soft brush, at least once each day.

4. As soon as a cavity appears, or if a tooth aches, consult a dentist.

Drinking with the Meals.—If the bread you are eating is a little dry, do not wash it down with a large quantity of water. Eat more slowly and take but little water. A single glass of water should be enough for any one meal. If that is not enough drink for the warmest weather, then you would better quench the thirst before going to the table, rather than wait until seated and then drink too much with the food.

Swallowing.—What do you do with a mouthful of food after you have thoroughly chewed it? "Swallow it," you say. Perhaps you have never thought that there was anything very curious about swallowing, but there is. Leading down the throat are two passages. Through one of these the air reaches the lungs. This passage you can feel at the front

of the throat. It is called the windpipe. The other is farther back and through it the food passes into the stomach.

The Windpipe.—Why does not the food go down the windpipe and choke us? Because over the top of the windpipe is a little lid which opens when we breathe, and shuts down tight when we swallow. Sometimes the lid does not shut quite quick enough, and we are choked. You say you have swallowed something the wrong way, but this rarely happens. This little lid works so well that, when we swallow, the food goes directly down into the stomach.

CHAPTER IV

MORE ABOUT DIGESTION

Dissolving the Food.—A lump of sugar is dry and hard; but what happens if you drop it in a couple of spoonfuls of water? It first softens, then melts, and mixes with the water until you can no longer see it. We say the sugar is dissolved in the water.

The food we eat must all be dissolved before it can be of use to the body. This dissolving is a large part of the work which is called digestion. It begins in the mouth.

The bread you take into your mouth may be hard and dry, but as you chew it, it is moistened and softened by the saliva of the mouth. Then it is swallowed and goes to the stomach to be further moistened, dissolved and otherwise changed.

The Gastric Juice.—How does the stomach change the food? By means of a juice, called

the gastric juice. As soon as the food reaches the stomach it mixes with this juice which the stomach makes. This is a very powerful juice, for it dissolves a large part of the food, and changes it all so much that it does not look at all as it did before it was eaten.

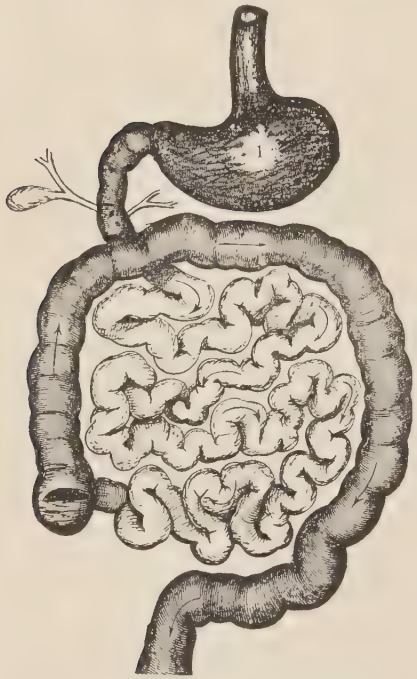


Fig. 2. 1, The stomach. Below this are the intestines.

The Intestines.—After the food leaves the stomach it passes out into the intestines, where it meets other juices that finish the work of the stomach. If you will look at Fig. 2, you will see how the long tube of the small intestine is so coiled that it takes but little room. The larger tube shown is the large intes-

tine, through which waste matter passes out of the body.

How do you suppose the digested food passes from the intestines into the blood? In this way: In the walls of the intestines are many blood vessels; and the food, which is now thin like water, soaks through the walls and into these blood vessels, mixes with the blood, and soon becomes a part of it. You will learn later how the blood carries the food to all parts of the body.

Digestion Reviewed.—Let us see if you can give a review of this story of digestion:—

First, the food is chewed. Second, it is swallowed. Third, it is mixed in the stomach with the gastric juice. Fourth, it passes out into the intestines. Fifth, in the intestines it is further changed and then soaks through the walls of the blood vessels and mixes with the blood.

You can see that it is not what we eat, but what we digest, that gives us health and strength. Young people are generally so healthy that they pay little attention to what

they eat or drink. But they will not always enjoy such health if they repeatedly break certain laws.

Do you think you could keep well if you should work all the time and never stop for rest? Then how can you expect your stomach to keep strong if you make it work constantly, as it must if you eat between meals?

Do not eat between meals.

Do not eat in a hurry.

Do not eat too rich food.

Do not eat just before going to bed.

Do not drink much ice-water or iced tea with your meals.

Do not drink or eat anything that has in it wine, beer, cider, or any liquor containing alcohol.

Do not be fretful and cross. Cheerfulness at table increases the appetite and aids digestion. In many homes the children are encouraged to tell at the dinner table each day the good stories and jokes that they hear.

CHAPTER V

EATING AND DRINKING

We have learned that if we wish to keep strong, the stomach must do its work well.

Some Foods to Avoid.—There are many things that harm the stomach. Eating unripe fruit, or too much rich food, often causes pain and severe stomach trouble. In fact, we have known persons to be very ill from rapidly drinking a large amount of ice-water when they were over-heated. Most of you are probably very fond of ice cream, yet if you eat too heartily of it you may suffer severely. These facts teach us that we must use knowledge and judgment in eating and in drinking.

Some Drinks to Avoid.—We should know, too, that there are drinks which are not good for the stomach. They make the inside of the stomach red, or inflamed, and act on the gastric juice so that it cannot digest the food

as it should. What are these drinks? They are wine, beer, cider, ale, rum, and all other drinks containing alcohol, which you will learn more about in another lesson.

Some people never take enough wine to get intoxicated, but they drink a glass or two with each meal. If we should ask one of them why he does so, he would probably reply that the drink helped his stomach to digest the food. He may have some trouble with his stomach; and he thinks the strong drink will help him. This is a mistaken idea. If such people would throw away all kinds of drink containing alcohol, eat only plain, simple food, exercise in the open air, and live rightly in other ways, it is probable that the trouble with their stomachs would soon pass away.

Tea and Coffee.—If boys and girls expect to keep in sound health, they must not form the habit of drinking tea or coffee. Nothing can take the place of pure water and pure milk.

Tobacco and Digestion.—A great many persons say they are obliged to smoke after eat-

ing, for if they do not, their food does not digest well. This is very bad reasoning, for the use of the tobacco itself often disturbs the digestion of the food. So smoking only makes a bad matter worse. A better thing for these persons would be to stop using tobacco altogether, but still better advice is: *Never begin to use tobacco.* For after one begins it is hard to let it alone, even when he finds that it is doing him harm.

CHAPTER VI

THE BLOOD

How Trees are Fed.—Were you ever out in the woods where they make maple sugar? If so, you know that a small hole is bored into the maple-tree, and from this there flows a clear fluid, which is called sap. This does not flow in a large stream, but only drop by drop. Now this sap is on its way from the tender roots of the tree to the little branches and leaves far above; it contains the food which makes the tree grow larger and taller.

Our Food Carrier.—Some time when you walk out into the country, see if you can find a plant called the milkweed; if so, break a large stem of it and notice what a thick, white juice comes from the end. This juice contains the food which makes the plant grow. Suppose you prick the end of your finger with a needle, what happens? A fluid

appears. This fluid is not clear, like the sap of the maple, nor white, like the juice of the milkweed, but it has a bright red color. What is the name of it? Blood.

The Blood.—The food that your stomach has digested goes to make up the blood. All parts of the body need blood as much as the tree needs sap, or the milkweed its white juice. Can you cut through the skin anywhere without causing the blood to flow? No, indeed, for it is freely distributed throughout the body. But there are a few places, for instance, the hair, the nails, and the outer part of the skin, in which there is no blood.

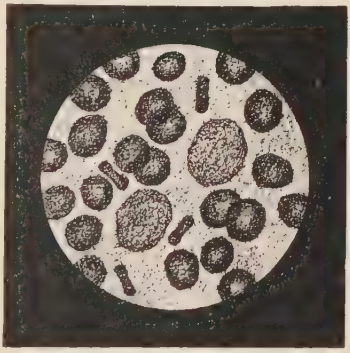


FIG. 3. Human blood as seen with a microscope.

What Makes It Red?—The blood would look clear like water were it not for some very minute bodies floating in it. These little bodies are flat and round, yet so small that thousands and thousands of them could

be placed side by side on the head of a pin. We know there are many millions of them in a single drop of blood. We often compare these little bodies to tiny boats, for they float in the blood, and carry what is needed from one part of the body to another. The color of these bodies is what gives the color to the blood. In Fig. 3 you can see how they look. Sometimes they make the blood appear a bright red color. Then again they make it much darker, a purplish red color.

Have you ever noticed how pale some persons are when in poor health? Their blood is not as red as it should be, or perhaps there is not enough of it. We are always glad to see boys and girls come in from play with red cheeks; we are sorry to see them with pale faces, for we know then that they are not in the best of health.

CHAPTER VII

THE HEART AND THE BLOOD VESSELS

How the Heart Works.—Did you ever send a stream of water through the rubber tube of a bulb syringe by pressing the bulb? When you squeeze the bulb you press out the water that is in it. When you stop squeezing, the bulb fills up again with water.

If you put your hand on your chest you will feel the motion of something that acts very much like the bulb of a syringe, only no

one has to press this; it squeezes together of itself. You say this is your heart. Every time the heart beats it squeezes itself up smaller and forces out the blood that was in it. Then it stops squeezing, enlarges, and fills up again with blood.

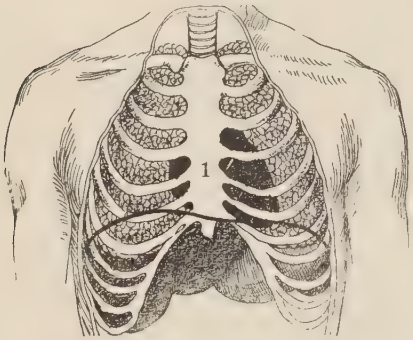


Fig. 4. The position of the heart. (1) The breast-bone. The heart is the pear-shaped body, shown in black, beneath the breast-bone.

Location and Size of the Heart.—The heart is a large hollow muscle. It is situated in the chest, between the lungs. If you look at Fig. 4, you will get an idea of the location of the heart. A good deal of the heart is directly beneath the breast-bone. A part of it is to the right of that bone; but the lower point of the heart is well over on the left side, and it is on the left side that we feel its beat.

Although the heart does so much work, yet it is not much larger than your closed fist. It

is shaped somewhat like a pear, with the small end down and to the left. The shape is well shown in Fig. 5. This figure also shows how the large blood vessels, through which the blood flows to and from the heart, enter and leave it.

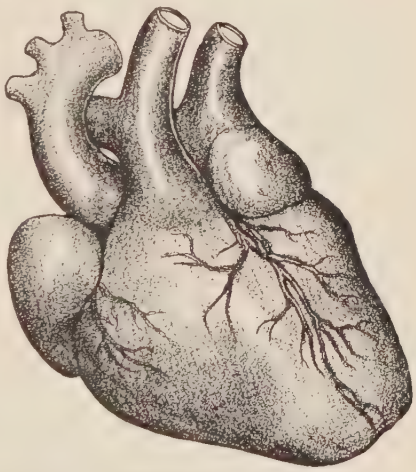


Fig. 5. The heart, and the large blood-vessels at its upper part.

How the Heart is Divided.—We have spoken of the heart as hollow, but there is more than one cavity in it. In the first place a firm wall, or partition, divides the heart into two parts, making the right side and the left side of the heart. This wall is so complete that not a particle of blood can go directly from one side of the heart to the other.

One of these days, you may learn how the large cavity on each side of the heart is divided into two cavities, so that really there

are four cavities in the heart, two for each side. But we will ask you to remember now only that there are two sides to the heart, and that the blood cannot go directly from one side to the other.

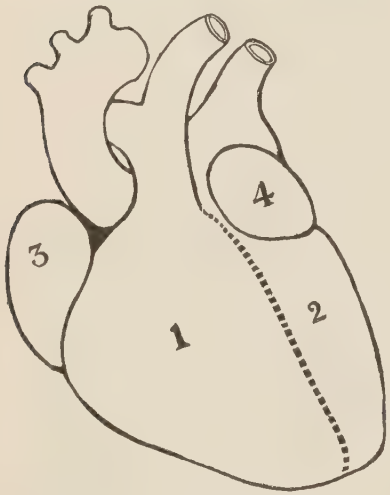


FIG. 6. This illustrates the firm wall which divides the heart into two parts. The wall is shown by the dotted line between the figures 1 and 2; 1 and 3 make the right side of the heart, 2 and 4 the left side.

The right side of the heart always contains the dark blood; and the left side, the bright red blood.

Arteries and Veins.—Look at the fire engine at work. It is a great big pump. The water goes into the engine through a pipe, which is fastened to a hydrant or placed in a cistern. How does the water leave the engine? By means of another pipe. The blood enters the heart, which is the pump of the body, and leaves it again through soft tubes, or pipes, called blood vessels.

The blood vessels carrying the blood *from* the heart are called arteries, and those carrying the blood *to* the heart are called veins. The arteries carry the bright blood, and the veins the dark blood. The bright blood in the arteries is the purest.

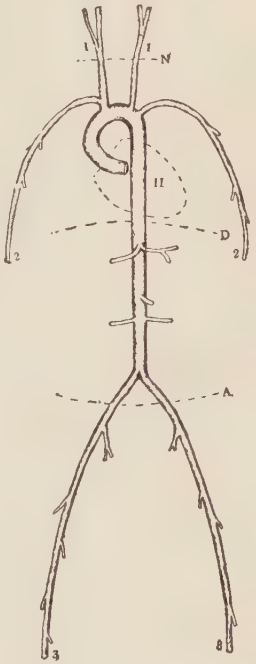


Fig. 7. H, the heart ; N, the neck ; D, the lower part of the chest ; A, the hips. The large blood vessels carry blood to the following parts : 1, to the head ; 2, to the arms ; 3, to the legs.

Are all the blood vessels of the same size? Most certainly not. Those nearest the heart are the largest; and as we examine the vessels farther and farther from the heart, we notice that they become smaller and smaller. Fig. 7 shows how one large artery starts from the heart, H, then, bending upon itself, goes down the body by the side of the backbone. Notice, too, how it gives off many branches on its

way. Some of these (1) go to the head, carrying food to the brain; others (2) go to the arms, taking food to the muscles; while other large branches (3) go to the legs. Now just imagine how, in this way, great numbers of little branches carry food to all parts of the body.

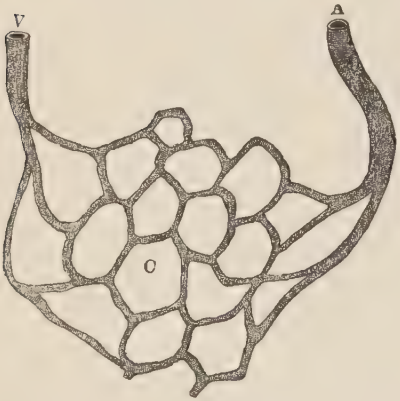


FIG. 8. A, a small artery; C, small blood vessels (called capillaries), very much enlarged; V, a small vein.

The Pulse.—Have you ever been so ill that a physician came to see you? And did he place his fingers on the thumb side of your wrist "to feel the pulse"? What was this for? Because the doctor wished to know how many times a minute your heart was beating. Each time the heart beats it sends out blood into the arteries, and this makes them swell out, or throb. All of the arteries throb in this way, but most of them lie so far below the surface of the body that we cannot feel the throb. You can very

easily feel one artery throb at the wrist, and you can feel another by gently pressing the fingers over the side of the neck.

The Branching of the Blood Vessels.—Look at Fig. 8 and notice how many times the artery, A, divides. It divides again and again until there is a perfect network of fine blood vessels, as shown at C. Notice, too, how these small blood vessels come together again until quite a large vein is formed at V. From this we learn that there is a fine network of small blood vessels throughout the body.

Let us now take a brief review of this lesson. First of all there is a little pump which we call the heart. When this is filled with blood it suddenly becomes smaller, pushing the bright blood through the arteries. This makes the arteries throb or pulsate. The arteries take the blood to the smallest blood vessels, these take it to the veins, and the veins take it directly back to the heart.

CHAPTER VIII

CARE OF THE HEART

Overworking the Heart.—What would you think of an engineer who did not know enough about the needs of his engine to keep it in good order; or if he knew how to do it, would not take the trouble? You would say he was unfit to be trusted with the care of an engine. The heart will do its work with much less care than an engine requires, yet it is an easy matter to put it out of order, or to throw so much unnecessary work upon it that it wears out before its time.

If you run or jump the rope until you feel "ready to drop," or if you race on your bicycle, or push it up a steep hill until you are out of breath and red in the face and your heart thumps so that you can feel it, you are then a bad engineer, not caring properly for the precious engine that has been trusted to your

keeping. By such overstraining people have so injured their hearts that they have been caused much trouble before regaining their full strength.

Yet exercise is good for the heart because it helps to keep the blood moving. One may be so lazy or spend so much time sitting still that the heart will have to do more than its share in keeping up the circulation. Children who are fond of out-door sports, or those who work and play in the open air until they are comfortably tired when night comes, get about the right amount of exercise.

Clothing that pinches any part of the body uncomfortably or presses too hard upon the blood vessels should not be worn, for it is then difficult for the blood to get through the blood vessels. A daily bath, on the other hand, helps to keep the blood vessels healthy.

Self Control.—A bad temper is almost as dangerous for the heart as overstraining at play. Anger that causes the face to redden or to turn pale, causes also sudden changes in the beating of the heart that do it harm.

Thus the person who gets in the habit of losing his temper over little troubles is a bad engineer for the little pump inside his breast. He is a disagreeable companion as well.

Did you ever see a man who had used a great deal of strong drink for a number of years? If so, you probably noticed that he had red eyes, red cheeks, and a red nose. What does this show? That there is trouble with the blood vessels of these parts. There is too much blood in them.

Palpitation.—Have you ever run or played so hard that you could scarcely get your breath? If so, did you notice that your heart beat very fast and hard? Almost painful, was it not? Sometimes the heart will beat in this way when we are greatly frightened. This rapid and violent beating of the heart is called palpitation.

Cigarettes and the Heart.—Boys have this palpitation of the heart from another cause—that is from smoking cigarettes. Boys who smoke often have these sudden attacks of rapid and violent action of the heart. The

heart beats very fast, then slower, then faster again. There is sometimes a faint and sickening feeling, with sharp pain in the left side. The doctors call this an "irritable heart," or a "tobacco heart." It may lead to very serious results.

No boy who smokes cigarettes or uses tobacco in any form is preparing to become a strong, healthy man.

CHAPTER IX

BREATHING

Where the Blood is Blue.—Look at the back of your hand or at your wrist. You see some blue lines. Perhaps you already know that these blue lines are blood vessels. But why do they look blue, when the blood is red? For the same reason that muddy water looks different from clear water. It has impurities in it which it must get rid of before it will look clear again. So the bluish-red blood which you see in your veins has impurities in it which it must get rid of before it will look bright red again. We may speak of this impure blood as blue, but we must remember that the color is not a real dark blue, but a dark bluish-red.

"But," you say, "if I cut or prick a vein in my hand and let a drop of blood out, it looks red!" Yes, as soon as the air touches

the dark blood some of the impurities pass off and something from the air passes in and makes it red again.

Where is the Blood Purified?—We cannot let all the blood in our veins out into the air to be purified, but there is a place in our bodies where the blood can get so close to the air that the impurities can pass out.

Where is this place? Not on the back of the hand, for there a thick skin, besides the heavy coats of the blood vessels, is between the blood and the air. Nor would it do to have such a place anywhere on the outside of the body, for a slight touch might let the blood come pouring out. So we see that this place must be inside of the body.

Put one hand on your knee and one on your chest. Which hand remains perfectly quiet? Which is moved gently up and down? What causes the hand on your chest to move? Take up the hand from your knee and with it pinch your nose and shut your lips tightly together; does the hand on your chest move up and down now? Why not?

What is constantly passing in and out of your nose? Where does the air go when you breath it in? Down into your chest, into a part of the body called the lungs. That is the place where the air and the blood get so close together that the impurities in the blood can pass off and something else which the body needs pass into the blood. Now you would like to know how the lungs look.

The Lungs.—You may think of a lung as made of a number of little sacs. The walls of these sacs are thinner than tissue paper.

There are also in the lungs many little blood vessels which have very thin coats. They almost cover the walls of each of the little air sacs. Here the air in the air sacs and the blood in the blood vessels come close together because there are only these very thin walls between them. So some of the air mixes with the blood and quickly changes its dark color to a bright red.

From this we learn that the blood obtains fresh air in the lungs. Does it give anything in exchange for this air? Yes. It gives up

many impurities gathered from all parts of the body.

When we breathe out the air, these impurities escape. If all this be true, do you think we should breathe the same air over and over again?

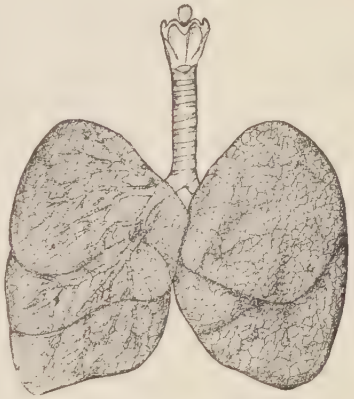


Fig. 9. The lungs; and the windpipe, which carries the air from the throat to the lungs.

What Breathing Does.—We will now review the story about breathing. Let us think what the two changes are that occur in the blood when it is in the lungs. First, it obtains a supply of fresh air which changes its color; and second, it gives up many impurities which pass from it to the air. After the blood is thus purified, where does it go? It flows back to the heart.

Where does the heart send the pure, bright blood? To every part of the body. Where does it send the impure, dark blood? To the

lungs. What are the lungs for? They give fresh air to the blood, and take impurities from it.

Did you ever see a physician place his ear over the chest to find out whether the lungs were healthy or not? He is able to tell this, because when the air passes into and out of the lungs, it makes certain sounds, which he will always hear if the lungs are in a healthy condition.

Do you think the lungs work all the time? You know we never stop breathing, not even at night. Yet, by watching your breathing, you will notice that there is a little time of rest between two breaths. But the lungs work hard, and we should give them plenty of room and a good supply of fresh air.

CHAPTER X

BREATHING AND HEALTH

Can you give a good reason why we should have plenty of fresh air about us all the time? Because the air we breathe out contains many impurities, and certainly we do not wish to take these back into the body.

The Lungs Need Room.—Can you expect the lungs to do their work well without plenty of room? Nature has given them all the room they need, but some persons wear their clothes so tight around the waist, that they make the lower part of the chest very small. Such persons cannot take a long, deep breath. How can you expect the body to grow and to develop, if it be bound tightly in this way? Tight lacing crowds many organs out of place, and sooner or later injures the health. Give the lungs plenty of room.

The Need of Fresh Air.—How can you tell when the air about you is impure? It is not always possible to do so; but it is likely to be impure if it has a disagreeable odor, or if it has been shut up in a room for some time, or if many persons have been in a closed room.

The pure, fresh, out-door air is what we need; it is the air in our houses and public buildings that is likely to be impure. It is not healthy to stay in a room and breathe the same air over and over again. The air can easily be changed by raising the lower sash of one window and lowering the upper sash of another. In churches and in all large buildings there should always be some special arrangement for changing the air.

Air in Sleeping Rooms.—Some people seem to think that it is only necessary to have fresh air in the daytime, and they pay no attention to their sleeping rooms. But breathing goes on at night just as well as during the day. Therefore, our sleeping rooms should have a constant supply of fresh air. Never sleep in a tightly closed room.

In winter there should be an open grate, or a ventilator, or some way of changing the air. During the warm nights of summer the windows can be opened wide; and even during the cold nights of winter it is safe for people

Exercise in the Open Air is Best.

who are well to have the windows open an inch or two.

In the morning open wide the windows of your sleeping rooms and let in the fresh outdoor air. Leave them open a good part of the day, for there is nothing better than fresh air to make one sleep well.

Bad Air Makes Us Dull.—Did you ever know a boy or a girl who could run very hard in playtime, and yet grew very dull and sleepy in the schoolroom? The school is not a good place in which to sleep or to have a headache. What is the matter with our dull scholar? Sometimes pupils become dull because the air in the schoolroom is not good. Let in plenty of pure air; there is nothing equal to it for making one love to study.

Draughts.—While so much has been said about breathing pure out-door air, yet it may be overdone. We must learn to be careful in this as in all other things. We should avoid currents of air. If a current of air—a draught, as it is called—should strike you on the back of the neck, it might cause a severe cold. If you have been playing hard and the body is moist, you should be especially careful to avoid all currents of air.

Breathing Tobacco Smoke. — Some persons are very careful to have pure air in every room of their houses, and yet they will often make it very impure by smoking cigars.

There are many people who greatly dislike the odor of tobacco smoke, and some people are made ill by it, yet it is often-times impossible to escape breathing the air thus selfishly poisoned by smokers.

Do you think it is any wonder that hot tobacco smoke injures the throat and lungs? Smokers often have a dry, hacking cough, while the "smoker's sore throat" is very common. There is no cure for these troubles unless the use of tobacco be given up altogether. Inhaling the smoke, or drawing it into the lungs is very injurious. How can one escape all these dangers? By refusing to begin the use of tobacco.

Alcohol and the Lungs.—People who use alcoholic drinks are very liable to coughs and colds. In fact, all forms of lung trouble are more severe in those who use alcoholic drinks.

Persons who have been chilled by bathing, or in some other way, often take some alcoholic liquor. They say they do this "to prevent taking cold." This is a mistake; for the

effect of alcohol is to lower the temperature of the body. A far better way when chilled from bathing is to rub the surface of the body thoroughly with a towel, until the skin is warm and red. If chilled in any other way, drink a cup of hot water, or some hot ginger tea.

CHAPTER XI

ALCOHOL

Fresh Fruits.—The writer remembers very well how, when a boy, he used to watch for the first ripe apples, and, later in the year, how he waited for the ripening of the grapes. How he loved to eat those fruits! It seems too bad that the juices of delicious sweet fruits like these can be so changed as to cause great injury to those who drink them. Yet we know that from these fruits such strong drinks as wine and brandy are made.

Is there anything in these fresh fruits that makes them so powerful to do harm? No, indeed; but when the juice is pressed out and allowed to stand the change soon begins.

Apple Juice and Cider.—If you should press the juice from some ripe sweet apples, what would you have? You would have apple juice, which is chiefly a mixture of water and

sugar, and flavoring matter. This is called cider. Now suppose you take this cider and expose it to the warm air for a few hours, then go and look at it. What will you see? Small bubbles coming to the top.

Alcohol Comes from Sugar.—When these bubbles appear, you say the cider is working, or fermenting. Is the cider still sweet to the taste? Not so sweet as it was at first; the sugar is beginning to disappear. "How can it disappear," do you ask? It is being changed into a gas and alcohol. The gas escapes in the form of the bubbles which you see; but the alcohol remains in the cider.

So we learn that alcohol is made from the sugar which is in the apples; in the same way alcohol is made from the sugar in grapes and other fruits.

Now, alcohol is a poison; and it is the alcohol in all the strong drinks which makes them so injurious. Any drink containing alcohol is dangerous, and should not be used. Alcohol may not kill at once those who use only a little at a time; yet it is a poison that

has power to injure the health, cause many diseases, and shorten life. It is also true that some persons have been killed at once by taking it in large doses.

The Work of the Ferments.—You may be wondering what makes the sugar that is in the ripe fruits change into gas and alcohol. Have you ever been in a darkened room and looked at a ray of sunlight as it entered? If so, you saw fine particles of dust dancing in the light. These seemed very small, did they not? Yet there are still smaller particles of matter floating everywhere in the air, smaller than we can see with the unaided eye.

There are many kinds of these tiny particles, and among them are some called ferments. Many of these ferments fall from the air upon the stems and skins of the fruit. When the juice of the fruits is pressed out these ferments are washed into it. Do you think, just because they are so small they can do nothing? If so, you are mistaken. They can change the sugar of sweet liquids into alcohol. You can see when the ferments are at work chang-

ing the sugar, by the bubbles that come to the surface.

Floating Ferments.—The ferments are very numerous, and of many different kinds. They float about in the air, not only lighting on the skins and stems of the fruits, but falling into mixtures which may be exposed to the air. "Then," you ask, "if we could only keep these little ferments away from the sweet mixtures, the sugar would not change to alcohol, would it?" No; the sugar would remain in its natural condition.

Why We Can Fruit.—The ferments that are washed into fruit juice when it is pressed out may be killed by boiling. Then, if the juice be bottled up so tightly that no more ferments can get into it from the air, the sugar will not be changed. Now you understand why canning fruit will keep it sweet and good. No ferments can pass through the tightly sealed cans or jars to the sweet juices within.

You all know that dry sugar does not change in this way. Why is this? Because the sugar must first be dissolved, to make

a sweet liquid in which the ferments can work.

Making Sugar from Grain.—Some boy says, "I thought beer was made from barley, and whiskey from corn. Certainly there is no sugar in these dry grains!" No, they do not taste sweet, but there is something in them which can be changed into sugar. Let us explain this, and you will see how it is brought about.

Corn Stalk.

Did you ever break open a kernel of corn or cut into a grain of barley? Bring a kernel of corn with you to school and show your schoolmates how beautiful and white the inside is. This is the corn starch, with which you are all so familiar.

How can this starch ever become alcohol?

Well, in the first place, it must be changed into sugar; and we know already how the ferments change sugar, when dissolved in water, into alcohol.

Do you know what would happen to the corn and barley if you should moisten them and keep them in a warm place? Certainly, every boy and girl knows the kernels would soon sprout and begin to grow. As they sprout and grow, the starch changes to sugar. So here we are at last, with sugar from our corn and barley.

Beer Making.—The brewer takes the corn and barley, and adds water to them until they begin to grow, when he knows that their starch is changed into sugar. He then grinds the grains or breaks them to pieces, and adds water to the ground mass. Soon the water dissolves out the sugar, and thus at last there is a sweet liquid. Then the brewer adds some yeast, which is a kind of ferment. The yeast changes the

sugar of the sweet liquid into gas and alcohol.

Why do not the ferments change sugar into alcohol while it is in the ripe fruits? Because the skins of the apples and other fruits will not allow the ferments to reach the sweet juices within them.

CHAPTER XII

ALCOHOLIC LIQUORS

Is there Alcohol in Apples?—How many of you have ever eaten apples? Did you think it wrong to swallow the juice of the apples? Most certainly not. Yet you know cider is made from the juice of apples, and we shall see that cider is a dangerous drink.

What, then, is the difference between the juice that is pressed from the apple at the mill, and that which you press from the apple by your own teeth? The difference is that there is no alcohol in the juice you get when you eat the apple, but alcohol soon forms in the juice that comes from the mill.

Alcohol in Pressed Apple Juice.—After apple juice has been pressed out and left exposed to the warm air for a few hours, it begins to ferment; and as the bubbles rise, we know that alcohol is being formed.

Why Cider is Harmful.—As soon as cider contains alcohol it is no longer a harmless drink. Alcohol usually begins to form in sweet cider within about six hours after the cider is made. As the ferments, day after day, change more of the sugar to alcohol, the cider is said to be growing "hard."

The person who begins to drink from a barrel of cider when it first comes from the press, and continues to drink daily the same amount, takes each day more and more alcohol.

Why will this do him harm? Because, for one reason, the alcohol in the cider may make him like alcohol so well that he will care more for it than for anything else. Even a little alcohol has the power to create an appetite for more.

For this reason it is never safe to use drinks that contain even a small amount of alcohol. Many a person who did not know this has gained a craving for strong alcoholic liquors simply by drinking cider.

The Power Beer Has.—Do you remember

how beer is made from barley? Ale and porter are made in much the same way.

Why should we not drink beer? Because it has the power to do great harm.

Beer has power to dull the mind and make one less able to think quickly and clearly.

Beer has power to create the craving that calls for the stronger alcoholic liquors.

How do we know that beer has the power to do all these things? Because it has done them again and again. What it has done once it has the power to do again.

Alcohol in Homemade Beer.—Some people wisely think that brewer's beer is very injurious. So they make a kind of their own from roots and hops. They add water to these and apply heat to get the strength from them. Then they add some sugar and yeast.

Do you think this homemade beer is harmless? Watch the mixture a few days, and you can tell. Notice the bubbles of gas rising to the surface, showing that the sugar is changing into gas and alcohol. The gas escapes, but the alcohol remains to form a

part of the root beer or hop beer. Now you know the mixture is harmful; for it contains alcohol.

How Wine Comes from Grapes.—Do you know of any fruit that looks prettier than a bunch of grapes? Grapes are not only beautiful, but they are also pleasant to the taste. The juice you get when you eat grapes is sweet and healthful; ferments cannot change the sugar in that juice to alcohol when it is in the grapes. But when the juice is pressed out, the ferments that are washed into it quickly begin to change its sugar into alcohol.

The alcohol that the ferments form in the liquid remains in it, and makes it poisonous. Thus we see why wine is a harmful drink, though made from healthful grapes.

The alcohol in wine, like that in beer and cider, has the power to create an appetite for more. Therefore the only safe rule is never to drink wine at all.

Some persons will not drink wine that is bought at a store, so they make it themselves. They take the juice of the grape, currant, or

elderberry and allow it to ferment, and then bottle it up for home use. But these home-made wines often contain more alcohol than the others, and are therefore more harmful.

Whiskey, brandy, and rum are very powerful drinks. They are at least one-half pure alcohol, and sometimes they are even stronger. Brandy is usually made from wine and cider; whiskey from corn, barley, and other grains; and rum from molasses.

Are Pure Liquors Wholesome?—We hear a great deal said about liquors being pure. Many people say that if only the best of grains and fruits were used, and if no drugs of any kind were added, then the liquors would be pure and wholesome. What a great mistake is this!

It is true that some liquors are made more harmful by having mixed with them many poisonous drugs; but any liquor that contains alcohol is both dangerous and harmful. It is the presence of this poison that makes all alcoholic liquors so highly injurious.

CHAPTER XIII

THE EFFECTS OF ALCOHOL

Water Quenches Thirst.—When you come running into the house after a hearty play, very warm and thirsty, a glass of cold water quenches your thirst, does it not? It certainly does not make you more thirsty, so that the more water you drink the more you desire. Indeed, when you come running into the house the next day, as warm and thirsty as before, the same amount of water will quench your thirst.

Alcohol Increases Thirst.—Drinks containing alcohol differ from water in this respect; instead of quenching thirst it is their nature to create thirst. The person who uses any strong drink is not likely to be satisfied with a small amount for more than a short time.

One glass of beer has the power to create a desire for another, until one glass is not sufficient; later on, beer does not satisfy, and

the stronger drinks are craved. In this way the appetite for strong drink is often formed. When this appetite is well fixed, it sometimes completely masters the person.

The Terrible Power of Alcohol.—The life of a drinking man is often divided into two chapters. The same words are in each chapter; but, alas! how different is their meaning!—Chapter I., The man could stop drinking if he would; Chapter II., The man would stop drinking if he could.

Is not such a power terrible? Yes, indeed; it is one of the most fearful things that can be said against alcohol.

Some of the very strongest and wisest men have thought they need not fear that this appetite would ever affect them. But often when too late they have found that it has completely conquered them. Students who have always mastered the hardest lessons have been completely mastered themselves by alcohol. Soldiers who have never yielded to the enemy in battle have yielded to the power of strong drink.

Some men drink beer because they think that it makes them strong and healthful. They say: "See what red and rosy cheeks we have and how large our muscles are," but the alcohol in the beer has deceived them. It makes the muscles large and soft and puffs up their faces, making the skin red and angry-looking, and as the alcohol has also dulled their minds they cannot see that they are not doing as much work as their fellow-workmen.

Would you like to know how to avoid this terrible power? Do you wish that it may never affect you in any way? Then refuse to take the first glass of cider, beer, wine, or any other drink that contains alcohol.

Did you ever hear a boy say that he knows this power can never affect him? Perhaps he thinks that if he should begin the use of strong drink, he could stop it at any time when he so desired. But that is not what the study of alcohol teaches. We should all remember that a little alcohol has the power to create an uncontrollable appetite for more.

None are sure of escape, if they begin its use.

A young person may not know that he has any desire for strong drink, until he has tasted some of the lighter drinks, or some sauce flavored with wine. It is easy to begin, "little by little," to walk in the road that leads to ruin and despair. It is also easy to begin in another road that leads to success and happiness.

CHAPTER XIV

TOBACCO

The Tobacco Plant.—Probably you all know that tobacco is made from the leaves of a plant. But do you know why it is that the tobacco leaf is used instead of the leaf of the beet or the cabbage? It is because tobacco leaves contain substances that are not in the

beet or cabbage leaf. These substances produce a quieting or stupefying effect upon the smoker, and it is this effect that the smoker comes to enjoy.

Nicotine a Poison.—Perhaps you have heard some of the older boys tell how sick the first use of tobacco made them. It was because they were suffering from the poisonous effects of the nicotine which is in the tobacco. These boys may tell you that the headache and the vomiting soon disappear, but they probably do not tell you about the slower effects of this poison which are sure to come, although we may not always know what they are.

Tobacco Benefits No One.—Did you ever ask persons who use tobacco whether it harms them? If so, perhaps some of them have told you that they are sure it does not; while others say they know it harms them, but they cannot break away from the habit. It is certainly true that tobacco injures those who use it—some more than others. Even those who think they are not harmed by its use, would find themselves much better off without it.

The reason why so many grown persons do not appear to suffer from using tobacco, is probably because they did not begin its use until their bodies had attained full growth. The grown body is stronger and is thus better able to resist harmful influences than the growing body.

Tobacco Harmful to the Young.—It is a positive fact that tobacco is very harmful to the young. We do not believe there is a single exception to this rule. Tobacco does immense harm to those who use it while the body is growing and developing. Its effects are not only serious but they are lasting. Here is a rule which you should all remember: *The younger the person using tobacco, the more serious will be its effects.*

Twenty-nine states in this country have passed laws forbidding the sale of tobacco to young persons. Can you tell why such laws are passed? Because the men who make the laws see that the use of tobacco is seriously injuring the boys who are to be the future men of the land.

Effects of Cigarettes.—Boys sometimes think that because cigarettes are so small there cannot be much harm in using them. This is a great mistake. No boy can smoke them without being more or less harmed. It is equally true that many boys have their health broken, their minds injured, and all their bright prospects for life ruined by these same little cigarettes.

Suppose you ask one of your playmates, "Why do you eat your dinner?" he will probably answer, "Because I am hungry." Ask him, "Why do you drink a glass of water?" He will tell you, "Because I am thirsty." He is always ready to give you a reasonable answer to such questions, is he not? But do you think any boy could give you a good reason for smoking?

Let any boy who smokes tell one good reason, if he can, why he uses cigarettes. There is no reason why boys should smoke, and many reasons why they should not.

CHAPTER XV

REASONS WHY BOYS SHOULD NOT SMOKE

Tobacco Takes Away the Appetite.—One of the first things we notice about a boy who smokes is that when meal time comes he is not very hungry. He does not eat enough good food, and without plenty of food his body cannot grow and become strong.

Tobacco Affects the Brain.—Such a boy often complains of being dizzy. He says he has a rush of blood to the head. He is troubled with horrible dreams, and awakes in the morning with a dull, heavy headache. He goes to school, but because he cannot study well, his standing in his classes is low.

Smoking is a Filthy Habit.—Notice the want of neatness in the boy who smokes! His teeth are dark colored; they have an offensive appearance; and the odor of the tobacco clings to his clothes.

Smoking Makes Boys Deceitful.—Do boys run away from home to eat their supper? Do they hide to comb their hair? Yet they will go away from home and hide to smoke their cigarettes. Why is this? Because they know that the practice is not a good one, and they are ashamed of it. Boys will deny that they use tobacco, when they will not tell a falsehood about anything else.

Smoking Leads to Drinking. — One of the sad things we have noticed as a result of smoking cigarettes, is that the boys who smoke are very likely to drink when they get older. The use of tobacco very early in life often creates a desire for strong drink.

Count how many headings there are in this chapter printed in black-faced type. Five, are there not? Read them over again. Do you not think that each one gives a good reason why boys should never smoke? Are not these enough to show that you are much better off without tobacco?

But suppose the boy who smokes wishes to defend himself. What will he say? Let him

begin to read all the books on physiology, study all there is said about the care of the health; and then tell us if he has found a single good thing about the use of tobacco. The best students and writers agree that tobacco is harmful.

CHAPTER XVI

THE MUSCLES

What the Muscles Do.—Did you ever see a piece of beefsteak before it was cooked? "Oh, yes, many times," you answer; "it is soft, and of a deep red color." Can you tell the name of the lean meat which makes the flesh of animals? It is called muscle.

Now let us see what the muscles are for.

Place your left hand over the front of your right arm and raise your forearm. You notice something that swells and becomes harder? This is a muscle which you feel as it shortens. We say it contracts. How do we know the muscle shortens? Because it moves the part to which it is fastened. Muscles are of such great use to us simply because they can shorten and then lengthen again.

The cheeks and the lips are nearly all muscle; and what is one of their uses? They enclose the mouth. Therefore, some of the muscles make walls for cavities. Perhaps you never thought before that a hole had to have walls.

Fig. 10. The upper part of the figure shows the muscles, while the lower part shows the slender white tendons at the wrist.

Muscles move the different parts of the body. Did you ever notice under what complete control you have your muscles? You can use one of them at a time, as in bending the end of a finger, or you can use a very large number of them, as in walking or running.

Control of the Muscles.—Can we make all the muscles contract whenever we wish? Let us experiment a little and so find out. We certainly can move the hands, the arms, the head, and many parts of the face, as often as we like. But how is it with the heart? The heart is made of muscle, yet it

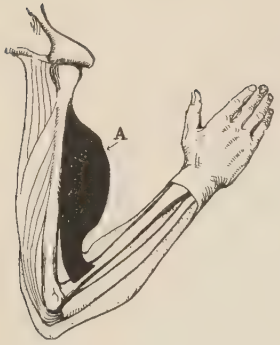


Fig. 11. A is the muscle on the front of the arm which raises the lower arm.

continues to beat, even during sleep, and we have no power to change its action. From this we learn that there are a few muscles which we cannot control.

How many muscles are there in the body? There are as many as five hundred, each one having a name and some special work to do. Are they all of the same size? No, for some are very large and long, reaching from the hip to the knee; while others are so small that they can scarcely be seen with the unaided eye. Do these muscles form a large or a small part of the body? You can decide when you know that muscles make up nearly one-half the weight of the body.

Fig. 12. B is the muscle on the back of the arm that straightens out the arm.

The Tendons.—Some of the muscles are fastened directly to the bones; while others end in white shining cords which are attached to the bones. These cords are called tendons. Did you ever notice them on the back of your hand? Bend your fingers back and forth; perhaps you will be able to see them. Now the muscles which move your fingers are in the forearm; but near the wrist, they end in these tendons, which, as shown in Fig. 10, extend from the wrist to the fingers.

FIG. 13. A is the muscle on the back of the leg which raises the heel.

FIG. 14. B is the muscle on the front of the leg which raises the toes.

How is it that your fingers move when the muscles moving them are in the forearm and not in the fingers? Because, when the muscles contract, they pull on these

cords or tendons which are fastened to the fingers.

With thick muscles around the fingers to move them, think what a large and clumsy hand you would have! Do you not see how the tendons save room, allow the parts to move more easily, and aid in giving a much better shape to the body?

How the Body is Moved.—Now let us look at Figs. 11 and 12, and see if we can learn how the muscles move parts of the body. Look at Fig. 11 first. Imagine that the muscle on the front of the arm contracts, or shortens, pulling on the cord, or tendon, which is fastened to the bone of the forearm. As this muscle shortens, it will raise the forearm and the hand with it.

By looking at the next two figures, it is easy to see that if the muscle in front shortens, it will raise the toes; while if the muscle at the back shortens, the heel will be raised and the toes lowered. Can you tell now what causes all the movements of the body? Certainly; the contraction of the muscles.

CHAPTER XVII

EXERCISE

Exercises Used to Develop the Lower Part of the Body.

Muscles Need Work.—Are all the boys and girls in your school equally strong? Cannot some of you run faster than others? What is the reason for this? Your muscles are all alike in shape, and of the same number. Of course sickness and poor health will keep some of you weak; but why is it that some boys always seem to be so much stronger than others, who are in the same good health?

One reason is because the stronger boy has given his muscles more work to do.

If we wish to keep our muscles healthy and strong, they must be made to work. How many of you have ever seen a blacksmith? Did you notice how large his arms were and what a hard blow he could strike? Do you think his arms were always so large and strong? No, indeed, it was the hard work he gave them to do which made them grow. And he keeps them large and stout because he continues his hard work.

Do you know what would make the muscles of your arm nearly disappear? Simply keeping the arm in a sling and not using it for a number of weeks. Without exercise the muscles become thin and soft, and nearly waste away.

Exercise Benefits the Whole Body.—But you must not think that the muscles are the only parts aided by exercise. How is it when you are taking a hard run? You breathe faster, and take in more fresh air. Your heart beats faster, and the blood flows more freely

through your body. What is the result of all this? You have a good appetite; you sleep well; and the whole body is greatly benefited.

Is it well for a boy to be all muscle and no brain? Are you pleased to hear of a boy

Exercises Used to Develop the Upper Part of the Body and Breathing.

who studies well and always knows his lessons, and yet suffers pain all the time? No, indeed. We all prefer to see a healthy body and a strong mind in the same person. Do you think from what we have said that you can have both of these if you exercise the one and neglect the other? Certainly not. Therefore play heartily and study earnestly.

Open Air the Place for Exercise.—You may think there is not very much sport in walking, yet it is one of the very best exercises for young and old. But let us combine pleasure with our exercise. So we will choose ball playing in summer, and sliding and skating in winter. Of course running and jumping are always in season. Still all this exercise will not do much good if taken in a close room. It is the fresh, pure air that is needed. No indoor exercise can possibly take the place of exercise in the open air.

We rarely hear of young boys studying too hard, yet they do sometimes play until the body is completely tired out. We often hear of girls who skip the rope until they are faint and ill. Now this is not the proper way to exercise, for it must be remembered that too violent exercise may cause severe illness.

Does Alcohol Give Strength?—Can a man walk better if he takes beer or wine or some other strong drink? Can he do more hard work if he is under the influence of alcohol? These are very important questions. Many

people have to work hard. If they could only do more work, they would be able to earn more money. But they cannot get more strength from alcohol.

Notice a person who is under the influence of strong drink! He has a staggering gait; his tongue is thick; and his fingers are clumsy. Has alcohol made his muscles stronger? Instead of being stronger they are weaker. Only a little more strong drink and the muscles would not hold the body up; the body would fall and become perfectly helpless. We shall learn in a later chapter that the delicate nerves have much to do in bringing about this result.

But you ask, "Suppose a person should take only a small amount of alcohol, a glass or two of beer or a glass of wine or a very little whiskey, would not this give strength to his muscles?" No, indeed. The workman with his ale or beer cannot do so much nor so good work as he can do without it.

CHAPTER XVIII

THE CLOTHING

How Clothing Keeps Us Warm.—Do you know why your body is chilly when exposed to the air? It is because the air about you is, except in the extreme heat of summer, colder than the body; so the body gives out its heat to the air. But where does the body get its heat? Does the clothing we wear make the heat of the body? No, the body itself does that; the clothing simply keeps the heat from leaving the body.

The clothing also protects the body from the direct rays of the sun; from the storms of rain and snow; and from many injuries.

The Choice of Clothing.—Now that you know the uses of clothing, would you advise any one to wear the same clothing in winter as in summer? No, indeed, even the animals teach us better. As the cold weather comes

on their fur coats thicken up, and the hair covering becomes so heavy that they are glad to shed part of it when spring comes again. Some people make the mistake of thinking that they can make themselves stronger by getting along without sufficient warm cloth-

An Eskimo Boy Wearing His Fur Clothes.

ing. Other people make the mistake of laying aside the winter flannels too early. Better wait until the summer weather is surely at hand before running any risk of taking cold.

All the clothing should be changed at night. Never sleep in any garment that has been worn during the day. If caught in a storm, hasten home, and change the damp clothing for dry.

Do not go about with damp feet. A great many sore throats and colds have been caused by wet feet.

Do you think that clothing must be very expensive in order to look attractive? We do not. We have seen boys and girls dressed in a most expensive manner, and yet there was something about their clothing that

Warmly Dressed for Winter Play.

was not pleasing. Remember, the simplest garments look well, if they are neat and clean.

Does Alcohol Warm the Body?—Did you ever take a long drive in the cold? How did you manage to keep warm? You put on extra clothing, did you not? Perhaps you had something warm to place at your feet. Did

you take a good, warm meal just before you started? Then so much the better.

Yet some persons think that they know a better way than this. They say that before starting on a cold journey they always take a glass of liquor, "for wine, or beer, or spirits, warms the body and keeps one from taking cold." Is there any truth in this? Does wine or brandy or any strong drink warm the whole body? No, indeed. Yet these persons say it does. Now, why is it that they are so mistaken? Because the alcohol makes more blood go to the skin. This makes the skin feel warmer; so the person thinks his whole body is warmer.

How Alcohol Lowers the Heat.—But the skin is warmer for only a few moments. When the blood is in the skin it is near the cool air, and thus heat is taken from it.

Does a dose of wine or brandy make the skin warmer? Yes. Why? Because it sends more blood to the skin. Does this last long? Only for a very short time. Are the deeper parts of the body warmed? No, only the

skin. Then is the whole body warmed by strong drink? No. It is often made colder.

Would you advise taking wine, or any other alcoholic drink, on a cold day? Certainly not. It would only make the body still colder.

If alcohol could make the body warmer, then those persons who have traveled in very cold countries would find it very useful. Yet the great Arctic explorers tell us that they never allowed the use of a single drop of alcoholic liquors. They all say that they could not have endured the extreme cold if they had used liquors.

Alcohol in the Tropics.—Persons who have traveled in the hottest countries, and officers who have charge of the soldiers in such places, write that they endure the excessive heat very much better without strong drink.

Thus we learn that strong drink is not good for men living in cold countries, nor for those in very warm countries. It will not feed us, neither will it clothe us. It seems to bring no good to any one, and may cause great harm to every one who uses it.

CHAPTER XIX

THE SKIN

The Cooling of the Body.—Can you tell of a garment given us by Nature that fits the body closely and never wears out? It is the skin. Have you ever noticed how soft and tight-fitting it is? Think how much wear there must be on this garment. It is constantly rubbing against the clothing, while every use of the towel in bathing must wear upon it. Yet it never wears out. The blood is always bringing it food, keeping it in perfect repair.

You know that sometimes when you prick yourself lightly with a pin the blood does not flow, but if the pin goes into the skin a little deeper, blood will surely flow. How do you account for this? Because the outer part of the skin has no blood vessels. How fortunate is this! If the blood vessels came to the very

outside of the skin, every little bruise or scratch would cause the blood to flow.

Fig. 15. A human hair (H), as it appears beneath the skin, in its sheath. G, the oil gland, which pours an oily substance around the hair.

A slight scratch of the pin does not really hurt. This is because there are no nerves in the outer part of the skin. How fortunate again! For if the nerves came to the surface, everything we touched would give us severe pain.

Oil Glands.—Have you ever noticed what smooth and glossy hair some persons have? Yet they may never use any kind of hair oil. Let us see if we can explain this. Deep in the skin there are some glands which make an oily substance that is poured around the base of each hair. If the scalp is healthy, the oil glands will furnish enough oil to keep the hair soft and smooth. If you

look at Fig. 15, you will see that part of a hair which is within its sheath, beneath the skin. Large oil glands are seen on either side of it.

Sweat Glands.—Sometimes during the warm weather of summer, or after you have been working or playing hard, the whole body becomes covered with moisture. Often the moisture gathers in little drops of water on the face. This moisture is called perspiration. Where do you suppose it comes from? It comes from glands called the sweat glands.

FIG. 16. The surface of the skin magnified, showing the openings of the sweat glands.

Look carefully at the palm of your hand, or at the inside of your fingers, and notice the minute lines or ridges. Now if you looked at these with a magnifying glass, they would appear like Fig. 16. Do you notice the little round pits in the figure?

You could see them on your own hand too if you had a magnifying glass. These little pits are the openings of the sweat glands. They are sometimes called the pores of the skin. If you look at Fig. 17, you will see some of these sweat glands, way down in the skin, looking like coiled tubes. The perspiration passes up the long, narrow tubes to the surface of the skin.

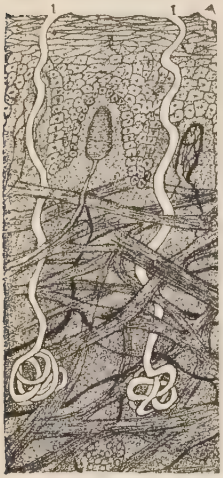


Fig. 17. (1) The narrow tubes which bring the perspiration to the surface from the sweat glands below. The sweat glands appear like closely coiled tubes.

From each little pore there comes only a small part of a drop of perspiration; yet, taken together, they make enough moisture to be seen. Sometimes the moisture gathers in great drops on the forehead and face.

Perspiration.—Even during the coldest weather of winter perspiration is coming through the skin all the time. You did not know it, because there is not always enough

of the perspiration to be seen or felt. Perspiration looks as if it were nothing more than water; but dissolved in it are salts and impurities which the body has thrown off. When the perspiration dries on the body, the salts and impurities remain on the skin. Do you see any reason why they should not remain there? What would follow if the tiny openings of the minute pores of the skin should get stopped up? The perspiration could not get out. Why then should one take a bath every day?

Bathing.—How many of you girls have birds? You give your birds a bath every morning; but birds are not as important as boys and girls. Our bodies certainly need bathing much more frequently than do the birds' bodies. The whole body should be bathed at least once each day.

When is the best time to bathe? When does your bird have his bath? In the morning. And the morning is the best time for your bath. While a bath at bedtime is refreshing and will often cause a better night's rest, a cool bath in the morning, immediately after rising, is the best. When you bathe each day, the bath can be taken quickly. It is necessary to have only a basin of water, a sponge or wash cloth, and a towel. Wet only a portion of the body at a time and dry it rapidly. The morning bath makes one feel better all through the day. Once a week a thorough tub bath, with soap and warm water, should be taken.

Be careful not to let the body cool too quickly when you are perspiring freely. After any hearty exercise, let the body cool gradually. Throw some light clothing over the shoulders, and avoid currents of air. Be cautious also about drinking too much cold water. Iced water at such times is dangerous unless sipped very slowly, a little at a time.

CHAPTER XX

THE BONES

The Framework of the Body.—You have been learning about the muscles, the blood vessels, and the skin. If our bodies were made only of these soft parts, would they keep their proper shape? Could we run and jump, if our limbs were only a mass of flesh? What do you suppose gives such a firm support to our bodies? Take hold of your arm and feel how hard it is in the center. We call these hard parts the support or framework of the body. This framework is made of a large number of bones.

What are Bones for?—The bones give proper shape to the body; they give support to the soft flesh; and they also protect many delicate parts from injury. They have still another important use. Nearly all the muscles are fastened to them. You have already learned

how the muscles move the bones, as in walking, running, and jumping.

Some of the bones are large and round, while others are thin and flat. How many bones do you suppose there are in the body? Over two hundred.

The Marrow.—Bones look very solid. Yet if you should saw a fresh bone open, you would find that the center of it is not hard. It is filled with a soft substance called marrow. You will not find this marrow, however, in the old bones you might pick up in the fields.

How Bones are Fed.—Even the outer part of the bone, that looks so solid to you, has very small openings, or holes, in it. You cannot see these with the unaided eye, yet the microscope shows them. These holes are filled with very small blood vessels. From this we learn that even so hard a substance as bone has blood flowing through all its parts.

When do Bones Bend Easily?—Why is it that boys and girls can tumble about and take such heavy falls without breaking their

bones? During old age this is not so; sometimes a slight fall will break the largest bone. The reason for this is that early in life the bones are neither so hard nor so brittle as they become when we grow older. They will even bend before they will break.

Have you ever seen a young tree bent, so that it is growing in an unnatural way? Now the bones, when they are young, can be made to grow in very unnatural shapes. Therefore we should be very careful to keep them in their natural positions by dressing, sitting, and walking in a proper manner.

CHAPTER XXI

THE SKELETON AND THE JOINTS

The bony framework of the body is called the skeleton. That we may study it better, we will divide the skeleton into three parts—the bones of the head, the bones of the trunk, and the bones of the limbs.

The Bones of the Head.—Where do you find the bones of your head? You can feel them underneath the skin and flesh of your forehead, nose, cheeks and chin. This part of the head is called the face, and these bones we may call the bones of the face. Can you find bones in any other part of your head? All the bones of the head make what is called the skull. The skull feels as if it were all one bone, but it is made up of several joined closely together.

The bones of the head do not form a solid mass, like a stone. They are more like a snail shell, in that they cover and protect the

soft parts inside the skull. What these are you will learn in another lesson.

The Trunk.—We call the main part of a tree its trunk, and we also speak of the main

Fig. 18. The Human figure, showing the chest and abdomen of the trunk, or main part of the body.

part of the body as the trunk. At the back of the trunk is the backbone; in front is the breast bone; on the sides are the ribs; and at the lower part are the hip bones.

Look at Fig. 18, and notice how the trunk is divided into two parts by an arch. This

arch is called the diaphragm; it is a thin wall of muscle. You will find it shown in Fig. 4. So you see there are two large rooms in the trunk.

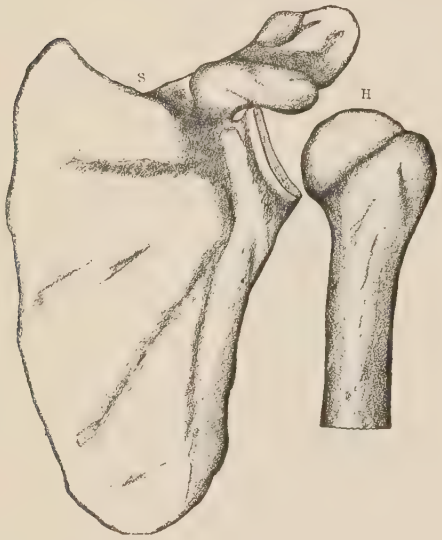


Fig. 19. The shoulder joint. S, the shoulder blade; H, the large bone of the arm.

The Chest.—The room above the arch of the trunk is called the chest. What are those slender, curved bones forming the sides of the chest, and showing so clearly in Fig. 4? They are the ribs; and there are twelve of them on each side. You can easily feel the ribs, but it is not easy to count the whole number.

The Abdomen.—The large room below the arch is called the abdomen. Are there any bony walls around this room? No, but the

muscles and the skin make a firm, strong covering for the parts within. If you will look at Fig. 2, you will see some of the organs that are in this lower room.

The Bones of the Arm.—Run your hand across the front of the upper part of your chest. Do you feel two slender bones there? These are called the collar bones. One end of each collar bone is shown in Fig. 4. Back of each collar bone, forming the back part of the shoulder, is a much larger bone, called the shoulder blade. How many bones do you think there are between the shoulder and the elbow? Only one. The upper end of this bone fits into the shoulder blade to make the shoulder joint; and the lower end fits into another bone to make the elbow joint.

How many bones can you feel between the elbow and the wrist? One, or two? There are two, placed side by side, and many of you can feel them, if you try, near the wrist. A number of small bones make the hand. Now count and see if you have five large bones belonging to each arm: the collar bone, the

Fig. 20. The thigh bone, the largest bone in the body.

shoulder blade, the large bone of the arm, and the two bones placed side by side.

The Bones of the Leg.—In many ways the bones of the leg are much like those of the arm. The largest leg bone fits into the side of a hip bone to make the hip joint. This long bone, extending from the hip to the knee, is the largest bone in the body. It is illustrated in Fig. 20, and the upper part of it again in Fig. 21. From the knee to the ankle there are two bones placed side by side. Can you think of a small bone we have not mentioned which is in front of the knee joint? Oh, yes; the knee-pan or knee "cap"; it protects the knee in front.

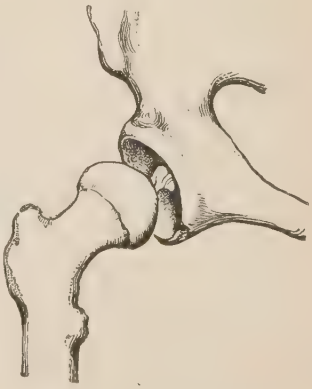


Fig. 21. The hip joint.

The Arch of the Foot.—Did you ever notice that the bottom of the foot does not rest flat upon the floor? This is because the small bones in the foot are arranged in the form of an arch. What is this arch for? Notice the spring in a wagon; it is made in the form of an arch. So this arch in the foot acts as a spring, preventing the body from being jarred too severely in running, jumping, etc.

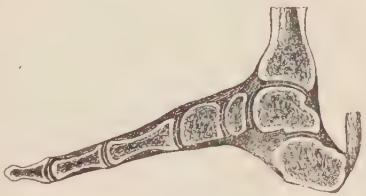


FIG. 22. The bones of the foot arranged in the form of an arch.

How the Joints Help Us.—Suppose you try, for a few moments, to keep your arm out straight, not allowing it to bend at the elbow in the least! Suppose you try to walk without bending your knees! Keep your fingers out straight, then try to pick up something! You would have a hard time getting along in this way. How fortunate it is that we have joints in our bodies!

How does the engineer keep the joints of his engine so that they always move easily

and smoothly? He oils them. See how easily you can move the joints of your fingers, but you do not have to oil them. All of your joints are kept moist by a fluid which answers the same purpose as oil. This fluid is called the joint water.

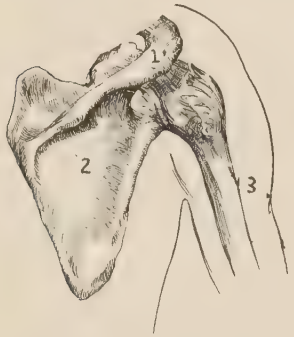


Fig. 23. The shoulder joint (1) covered by its ligaments; (2) the shoulder blade; (3) the arm bone.

The Ligaments.—What holds the ends of the bones together at the joints? Strong white bands of tissue, called ligaments. Look at Fig. 23 and see how completely these bands cover the bones of the shoulder joint. Yet beneath the bands we know that the bones look as in Fig. 19.

Did you ever hear of anyone getting a finger, or an arm, or a leg "out of joint"? How could it get out of place if these bands of tissue were around it? A hard wrench may cause the bone to break its way through the bands.

Did you ever "sprain" your ankle or your wrist? A sprain is sometimes very painful and causes trouble for a long time. The bones are not injured in a sprain. It is the ligaments that are injured.

CHAPTER XXII

THE CARE OF THE BONES

The Erect Figure.— How often we see young people stooping as they walk. The body bends forward, and the shoulders are drawn toward each other. This is bad; because when the bones are young they bend easily, and thus may grow out of shape. Unless one is careful to sit and stand erect, he may grow up narrow-chested and round-shouldered.

To have a fine figure one should walk with the whole body erect, and the chest held high. Later in life, when the bones become harder, you will be able to walk in this way without

giving any thought to holding the body properly.

Do you know of any boys or girls who bend over their books while sitting at their desks, like the little girl in the picture? Do

A Bad Position for Reading or Study.

you ever sit on one foot, or take other awkward positions? When you are at home, do you ever slide down in an easy chair, or bend over your sewing or reading? You certainly would not allow yourself to fall into any of these positions if you appreciated that the shape of the bones can be easily changed

when they are growing. Study the three reading positions taken by the boy shown on pages 110 and 111, and be ready to tell why it is not well for him to sit in the incorrect positions shown. For the same reason you can now do much toward making yourself erect.

One Way of Weakening the Ankles.

A Bad Position for Reading.

Tight Clothing.—Pressing the ribs too tightly about the waist injures the health. The clothing can be made to fit snugly and neatly, and yet not be tight enough to change the natural form

"All Crouched Up."

Sensible Shoes.—Do your shoes ever pinch your feet? They should not; for shoes are made to protect the feet and not to change their shape. The heel of the foot was made to share the weight of the body with the ball of the foot. But high-heeled shoes lift the heel much farther from the ground than the ball, and thus throw more of the weight of the body on the forward part of the foot than it was made to bear. High heels also give an awkward, stiff appearance to the walk.

In Position for Reading.

For boys and girls "spring heels" are best. But even with the right shoes, a child sometimes stands badly. If the girl in the picture were your little sister, what would you advise her to do?

Alcohol Checks Growth.—Our bones grow larger and stronger as our bodies grow; and for this reason we should be very careful to take nothing that will check or harm their growth. Children who are given beer, wine, brandy or other alcoholic drinks while they are very young do not grow so fast nor so large as they should.

Effects of Cigarettes.—Boys who begin the use of cigarettes at an early age, and keep up the habit for years, seldom reach their full growth. The effects of cigarettes on a young, growing body are much more serious than on a body which has reached its growth. The boy who dwarfs his body during the growing time of life can never afterward gain what he has lost. He must go through life with a less perfect body than he might have had but for his foolishness in learning to smoke.

CHAPTER XXIII

THE BRAIN, SPINAL CORD, AND NERVES

How the Brain is Protected. — You have learned that the skull is a hard bony covering. We shall now see that it covers and protects the most precious part of the body, the part that thinks. We call this the brain. Think how many hard knocks the skull receives during an ordinary life! If these knocks fell directly on the brain they would seriously injure it; but within the skull it is quite safe.

What the Brain Does. — What is this brain for? Why, it is with the brain that you think and study and remember what is told you.

When you were studying about muscles, you were told that they were made strong by proper exercise. This is also true of the brain. Using the brain makes it stronger. How can we use it? By studying at school, by reading good books at home, and by keep-

ing noble and kind thoughts in the mind. You have a great help in life if you always choose good books and good companions.

When the Brain Rests.—You learned that the heart rests a trifle after each beat and

Fig. 24. A human brain. 1 and 2, the brain; 3, the beginning of the spinal cord.

that the lungs rest a short time after each breath. The brain, as well as all other parts of the body, must have rest. Can you tell what brings rest to the brain? Sleep. In sleep the whole body rests. Without sleep a person cannot long remain in good health. When you feel sleepy it is a sign that your whole

body needs rest. "Bed time" is really one of the best friends a child has.

When to Sleep.—The growing body needs a great deal of sleep. Each night should bring plenty of it. The best time for sleep is in the early part of the night. Go to bed early. Do not lie in bed after waking up in the morning. Get up early, and enjoy the most beautiful part of the day.

The Nerves.—Suppose you prick the end of your finger with a needle. How does the pain get to your brain? In this way: The needle touches a little nerve in the end of the finger. This nerve carries the message of pain up the arm until it reaches the spinal cord, then the message travels up the spinal cord to the brain.

The Spinal Cord.—Fig. 25 will help you to understand how the message travels. You will notice there that the brain is at the top. Below the brain is the spinal cord. This goes from the brain down the center of the backbone. Notice some large nerves going from it to the arms and the lower limbs.

Thus the nerves carry messages from one part of the body to another. They can carry many kinds of messages, and in many directions. Some of these messages tell the brain what is happening at various parts of the body. Others are orders from the brain, telling these parts what to do.

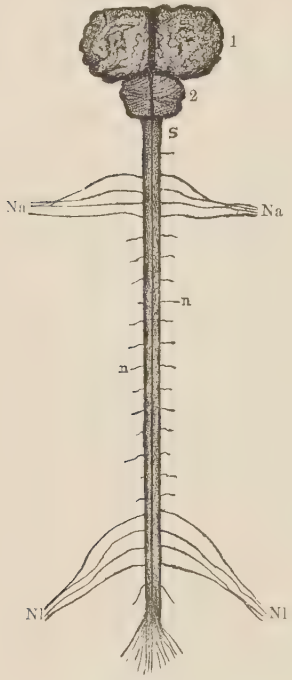


Fig. 25. 1 and 2, the brain. This is another view of the brain as shown in Fig. 24. S, the spinal cord; Na, large nerves that go to the arms. Nl, large nerves that go to the legs; n, small nerves that go to the skin.

There are some strange things about these nerves. Some of them can do special things and nothing else. For instance, the nerves of the eye can do nothing but carry messages of light from the eyes to the brain; and the nerves of the ears carry only messages of sound.

The Five Senses. — These special nerves

give the senses. We generally say there are five senses. Can you name them? They are sight, smell, taste, touch, and hearing.

Alcohol Injures the Brain.—Since the work of the brain is to think, the best brain is the one that can do the best thinking. Watch the class in mental arithmetic thinking out the answer to a problem. How eager each one is to get the answer first and to have it correct. No boy or girl wishes to have a brain that is stupid and dull.

We have learned that the way to strengthen the brain is by exercise. We need also to know how to avoid weakening the brain. Poor food, bad air, lack of proper exercise tend to weaken the brain, but worse still are alcoholic drinks, tobacco, and a few other brain poisons.

When a person takes even a small quantity of alcohol, his brain begins to be affected by it. He cannot think as clearly. He says things that his good sense would keep him from saying if he had not taken the alcohol.

Who can tell what a man will do when under the influence of strong drink? He may quarrel with his best friends without a cause. He is likely to be cruel to those whom he should love and care for, though he may be kind and tender when sober.

Does a person have to be intoxicated in order to have his brain harmed? No, indeed. Even small doses, long continued, often weaken the mind. A person who has a weak mind is not likely to succeed in life. He cannot think or work well. His sense of right is dulled; and even if he sees what is right his will is so weak that he fails to act as he should.

A man frequently knows that he is ruining himself with alcoholic liquors, and he resolves that he will stop using them. But his appetite for alcoholic drinks is too often stronger than his will, and so he keeps on drinking.

No one can afford to run the slightest risk of forming a habit that may result in such great injury.

Tobacco and the Brain.—It is a sad fact that many young boys are forming a habit that

will harm their brains. Any boy who keeps his eyes open must see that tobacco has this effect. Those who use it are generally the poorest students in the school. Do you want to know where to find the boy who smokes? Well, never go to the head of the class for him. Look down toward the foot of the class. Tobacco so affects the brain that besides making a boy a poorer scholar than he would otherwise be, it often leads him to be deceitful and untruthful.

CHAPTER XXIV

THE SENSE OF SIGHT

How the Eyes are Protected.—Did you ever notice how well the eyes are protected? No harm can easily come to them from the back or from the sides. In fact, they are well sur-

Fig. 26.

rounded by bone except in the front, which must be left open for the light to enter.

There are other ways in which the eyes are protected. Notice the eyelids, how freely and quickly they can be moved. Of what use are those little delicate hairs, called the lashes, on the edges of the lids? They keep dust and insects from touching the eyeball.

The Pupil. — Look at the eyes of one of your friends. Do you notice that round black spot? It is called the pupil. It is only a round hole. What is this for? To let the light into the eye. All the light goes through the pupil.

Ask one of your friends to go to the window, where the light can fall directly on the eye. Look carefully now at this little pupil, and notice that it is getting smaller and smaller. Now have your friend cover his eye with his hand for a minute or two. Be ready to look quickly, as soon as he removes his hand. When he removes it, notice that the pupil is much larger.

Why the Pupil Changes.—From this change we learn that when the light is bright the pupil is small, but when the light is dim the pupil is large. Did you ever see the pupil of a cat's eye? When next you see a cat notice what a long narrow slit the pupil of his eye is. If you cover the eye for a moment, or take the cat into a darker room, the pupil becomes very large and round.

Why does the pupil change so? It grows large in the dark in order to let more light into the eye. If it stayed equally large when we were out in the sunshine too much light would go into the eye.

Have you ever seen a person who is blind? How sad is such a misfortune, and how brave many are in "making the best of it." Some of you may have been obliged to remain in a darkened room, because you had some trouble with your eyes. How you wished once more to be out in the bright daylight! Indeed, we hardly realize unless we lose it what a precious gift is the sense of sight.

The Care of the Eyes.—You should remember a few things that may aid you in preserving your eyes and in keeping them strong: If your eyes are red or inflamed, or if reading gives you a headache, or if any use of the eyes gives you pain, you should consult a physician at once. Do not do such foolish things as squinting, trying to look cross-eyed, or turning the eyes in an unnatural way. Looking at bright lights, such as the sun or

electric lights, is also injurious. It is worth while to be careful of the eyes. When injured in any way they are slow in recovery, and many times they are never right again.

If you should chance to get some dirt or dust into the eyes, some one may remove this for you by carefully wiping the eye with the folded corner of a soft handkerchief. Do not rub the eyes.

It is a well-known fact that alcohol, even in the lighter liquors, such as cider, beer, and wine, often injures the sense of sight.

Do you remember what we said about the red eyes of the hard drinker? Sometimes they are so affected that they look bloodshot all the time. It is useless for such a person to ask the doctor to cure his eyes as long as he uses strong drink.

Tobacco smoke is bad for the eyes. It weakens and inflames them, and often makes the eyelids red along the edges.

CHAPTER XXV

SMELL, TASTE, TOUCH, AND HEARING

Smell.—Is not the odor from the apple orchard, when it is in full bloom, most delightful? And who does not enjoy the perfume of the rose? The sense of smell is useful to us in many ways. It enables us to enjoy more fully many fruits and flowers. It also tells of the presence of things that are harmful to the body. You do not like to eat food that has a tainted smell. Neither do you like to breathe air in which there is a bad odor.

Taste.—Do you like the taste of olives? And did you, the first time you tried to eat them? How is it with tomatoes and oysters? Do you like them now, and were you always fond of them? Sometimes things which were disagreeable to us at first finally become very agreeable. Thus we learn that the sense of taste can be educated.

Tobacco greatly affects the taste. The tongue, and all the tissues around the mouth, become filled with the flavor of tobacco. This flavor remains in the mouth all the time, thus preventing the person from enjoying the true taste of anything. Notice that the tobacco user is fond of spices and strong "relishes." You can now understand why.

Touch.—We asked in the last chapter if you had ever seen a blind person. If so, did you ever see him read one of his books by passing his fingers over the letters? They are sometimes like the letters on this page, but are slightly raised above the surface of the paper, just high enough to be felt by the finger as they are passed lightly over the letters. It would be very difficult for us to read them. This shows how highly the sense of touch can be trained. This sense is in the skin, and extends over the whole body.

Hearing.—Do not think that what you can see on the side of the head is all there is to the ear. The real organ of hearing is deep in the bones back of the ear. The part you call

the ear is of use only to catch the sound and to send it along a canal to the deeper parts.

It is a great misfortune to lose the hearing, yet how careless many persons are about preserving it! You should not clean the ears with a pin, nor with any other hard substance. By failing to observe this rule trouble is often caused, which results in a gradual failing of the hearing.

Did you ever shout loudly in any one's ear? You certainly will never do it again, after you learn that it might cause deafness. Blows on the ears are always dangerous. You should not allow cold air to blow into your ears; it often causes a cold from which serious troubles with the ear may follow.

INDEX

Abdomen, 102.
Air, effect of bad, 50.
in sleeping rooms, 48.
need of fresh, 48.
Alcohol as a poison, 54, 64.
effect of, on the brain, 117.
on the growth, 112.
on the lungs, 51.
on the muscles, 85.
on the sight, 123.
on thirst, 66.
on the warmth of the body, 88.
growth of taste for, 61, 66, 118.
in fruit juice, 53, 60, 63.
in the Tropics, 90.
Arteries, 34.
pulse in the, 36.

Bathing, value of, 39, 95.
Beer, 58.
effect of, 61.
home-made, 62.
Blood, 28.
coloring of the, 29.
purification of the, 43.
venous, 42.
Blood-vessels, 34, 37.
effect of liquor on, 40.
Bones, care of the, 108.
hardening of the, 98.
lime in the, 11.
number of, 98.
Bones—
of the arm, 103.
chest, 102.
foot, 105.
head, 100.
leg, 104.
trunk, 101.
use of the, 97.
Brain, 113.
effect of alcohol on the, 117.
tobacco on the, 118.
work of the, 113.
Bread, hot, 15.
Breathing, 43.
of tobacco-smoke, 50.

Candy, 8.
Chill, treatment of, 51.
Cider, 61.
Cigarettes, effects of, 72, 112.
Clothing at night, 87.
choice of, 86.
tight, 39, 47, 110.
Coffee, 26.

Desserts, 16.
Digestion, 17, 21.
organs of, 21.
process of, 23.
Drink, what to, 8, 15.
what not to, 24, 25.

Ears, care of the, 126.
Eating, what to avoid in, 24.

Exercise, benefits of, 39, 82.
injurious, 84.
place for, 84.
Eyelids, 120.
Eyes, care of the, 122.
protection of the, 120.
pupil of the, 121.

Fermentation, alcoholic, 54.
Ferments, 55.
floating, 56, 59.
Foods, desirable, 6, 16.
fruit, 7.
sweet, 8.
undesirable, 16, 25.
Fruit, canned, 56.

Gastric juice, 21.
Glands, oil, 92.
sweat, 93.
Growth, 1.

Hearing, sense of, 125.
Heart, action of, 31.
care of the, 38.
cavities of the, 33.
effect of tobacco on the, 40.
location and size of the, 32.
palpitation of the, 40.

Intestines, 22.

Joints, use of, 105.

Ligaments, 106.
Lime in the bones, 11.
Lungs, 44.
effect of alcohol on the, 51.
tobacco on the, 51.

Marrow, 98.
Meats, which to choose, 13, 16.
Muscles, 76.
control of, 77.
effect of alcohol on, 85.
needs of, 81.
number of, 78.
use of, 77, 80.

Nerves, 115.
Nicotine, 69.

Perspiration, 94.
danger of checking, 96.
Pulse, 36.

Saliva, 17.
use of, 21.
Salt, need of, 10.
as a flavor, 15.
Senses, 117.
Shoes, need of well-fitting, 111.
evils of high-heeled, 111.
Skin, 91.
pores of the, 93.
Sleep, 114.
when to, 115.
Smell, sense of, 124.
Spices, 15.
Spinal cord, 115.
Stomach, cause of trouble in, 15, 17, 25.
Sugar made from grain, 58.

Taste, sense of, 124.
Tea, 26.
Teeth, 17.
care of, 18.
Temper, dangers of bad, 39.
Tendons, 79.
Throat, effect of tobacco on, 51.
Tobacco, 69.
as a poison, 70.

Tobacco—
effects of, on the brain, 117, 118.
on the digestion, 26.
on the heart, 40.
on the lungs, 51.
on the sight, 123.
on the taste, 125.
on the young, 70.
laws against, 71.
reasons for avoiding, 73.
Touch, sense of, 125.

Vegetables, which to choose, 14, 16.
Veins, 34.

Water, iced, 10.
impure, 10.
necessity of drinking, 9.
quantity of, in the body, 9.
with meals, 19.
Windpipe, 20.
Wine, 63.
home-made, 63.

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